

Coffee jellies - the nutritional, sensory, and physicochemical characterization

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Abstract

The purpose of this study was to take advantage of the benefits of coffee consumption in the form of jelly. In this regard, jelly recipes were designed using agar-agar and gelatin as gelling agents, in versions with classic coffee prepared with water and with oat "milk." All jellies showed very good acceptability after evaluating their sensory characteristics. The acidity of the gelatin jellies (0.37-0.4 degrees of acidity) was higher than that of the agar jellies (0.22-0.25 degrees of acidity), and the "espresso" jellies had higher acidity than those with oat drink. The highest total soluble solids (TSS) content was recorded in the gelatin jellies (49.6 Brix) and those with oat "milk." The water content of the gelatin jellies (36-38%) was higher than that of the agar jellies (30-33%), and the oat "milk" jellies had a higher water content than the "espresso" ones. The polyphenol content and antioxidant activity were higher in the "espresso" jellies (15.42 - 15.71%, respectively 26.8 - 27.6 mgGAE/g) than in those with oat "milk" (15.29 - 15.38%, respectively 25.3 - 26.4 mgGAE/g). The energy values of the jellies varied between 106.19 and 183.42 kcal/100 g. The jellies with oat "milk" had more calories than the others. The gelatin jellies had the highest energy values of 123.8 and 183.42 kcal, while those with agar had 110.88 and 150.59 kcal.

Keywords: coffee jelly, sensorial and physico-chemical characteristics, polyphenols, antioxidant activity

1. Introduction

Usually, jellies are products obtained by mixing fruit juices, sugar and various gelling agents. They have a gelatinous consistency and are often used as desserts or as fillings for cakes, tarts, or other dishes [13]. Due to short-term thermal treatment of ingredients, there are conditions for preserving considerable amounts of valuable bioactive compounds.

However, some consumers have been captivated by jellies that are not derived from fruit. One such jelly is coffee jelly.

In Romania, coffee jelly is less known and

consumed than fruit jellies. Coffee jelly represents an interesting fusion between coffee and a gelling agent. Known as a significant source of bioactive compounds and having such great popularity, coffee deserves to be consumed in the form of jelly as well. Its great popularity among consumers, is not only for its taste, but also for its benefits for consumer health.

Due to its chemical composition, coffee is included in the list of functional foods. The chemical composition of coffee contributes to its unique flavor (bitter, acid, and astringent)

[Farah, 2012, quoted by 21] and potential health benefits.

Key components include phenolic compounds, which have antioxidant properties, and alkaloids like caffeine, which acts as a stimulant. Coffee also contains diterpenes, carbohydrates, lipids, and various volatile compounds [12]. Besides its well-known phenolic compounds, coffee also contains cinnamic acids, cinnamaldehydes, and proanthocyanidins. These compounds contribute to coffee's antioxidant activity and have potential health benefits, including anti-inflammatory, antidiabetic, anticancer, cardioprotective, and antimicrobial effects. Chlorogenic acid is another important bioactive compound found in coffee. It possesses antioxidant, anti-cancer, neuroprotective, anti-inflammatory, and antiviral properties, contributing to coffee's potential health benefits [1, 12].

Caffeine can improve memory, focus, and attention, as well as boost mood. Studies have also linked moderate caffeine consumption to a reduced risk of chronic diseases such as heart disease, type 2 diabetes, Parkinson's disease, and Alzheimer's disease [1, 7].

As a result of the Maillard compounds formation after roasted coffee been, melanoidins are produced, too [1, 4].

There are a lot of researchers that have been study antioxidant activity [1, 3, 4, 5, 12] and polyphenols content of coffee [8, 10, 11], but literature date are poor in studies about jelly coffee [15].

Gelling agents are substances used to achieve a gelatinous texture in various preparations. These agents play a crucial role in the food industry, contributing to the creation of desired textures in different products. Among the gelling agents, we mention agar-agar, pectin, xanthan gum and gelatin.

Agar is a complex carbohydrate (polysaccharide) that forms gels. Its structure consists of repeating galactose units with a unique arrangement of chemical bonds. Some of the galactose units are also modified with sulfate groups, which influence its properties [9]. Agar is often used in vegetarian and vegan preparations because it does not contain animal-derived ingredients.

Gelatin is a versatile protein derived from collagen. Its unique amino acid sequence makes it useful in various applications, including food, pharmaceuticals, and cosmetics. It also offers potential health

benefits due to its composition [2, 18, 20].

Considering the presented aspects, the aim of this study was to produce coffee jellies and to analyze their sensory, physicochemical, and nutritional properties.

2. Materials and method

2.1. Coffee jellies preparation

Jelly recipes were designed using agar-agar (A) and gelatin (G) as gelling agents, in versions with classic coffee prepared with water (G-CJ Espresso and A-CJ Espresso) and with oat "milk" (G-CJ OM and A-CJ OM). For the preparation of the jellies, we used 30 g of ground coffee, 160 g of water or oat "milk", 10 g of gelatin or 3.5 g of agar-agar, and 5 g of unrefined cane sugar.

2.2. Sensory evaluation

In order to assess the acceptability of coffee jellies were evaluated: appearance, color, consistency, smell and taste, using hedonic scale with 9 points.

2.3. Moisture determination

The oven drying method at 105°C was used to determine the water content, the results being expressed in %.

2.4. Determination of acidity

The acidity was determined by the direct titration method with NaOH 0,1n and it was expressed by acidity degrees

2.5. Total solids soluble (TSS) determination

The refractometric method was used to determine the total soluble solids content and the results were expressed in degrees Brix.

Antioxidant capacity evaluation

Radical scavenging activity (RSA) method was used to evaluate antioxidant activity. The results were expressed in %.

2.6. Total polyphenols content

To quantified the total polyphenols content, Folin-Ciocalteu spectrophotometric assay was used. The results were expressed in mg GAE/g. All determinations were performed in triplicate.

2.7. Proximate composition

In order to determined proximate composition, it was using The Nutritional Database USDA.

3. Results and discussions

The description of the sensory parameters evaluated is shown in the table 1.

Table 1 Sensory characteristics of coffee jelly

Characteristics	Description
Appearance	specific shape of the mold
Colour	specific to the ingredients used, from beige to dark; brown blackish brown for the "espresso" jellies; caramel for the oat "milk" variant
Smell	pleasant, specific
Taste and flavor	pleasant, characteristic, coffee; bitter in the "espresso" variant; slightly sweet in the oat "milk" variant
Consistency	soft and more elastic - variant with gelatin; firm and more stable - variant with agar-agar

The appearance of the jellies obtained scores between 8.5 - 8.83 (figure 1), depending on the gelling agent used, and the most appreciated color was that of the "espresso" coffee jellies. The jellies with gelatin were appreciated for their soft and elastic texture, while those with agar-agar were described as being firmer. The smell of all types of jellies was appreciated with very high scores.

The taste was appreciated differently, with the agar-agar jellies being more appreciated, than those with gelatin.

The gelatin jellies were appreciated for their mild and balanced taste, while the agar-agar jellies were described as having a more intense coffee flavor, but with a reduced sweetness.

The coffee aroma was perceived more intense in the agar-agar jellies, than gelatin jellies.

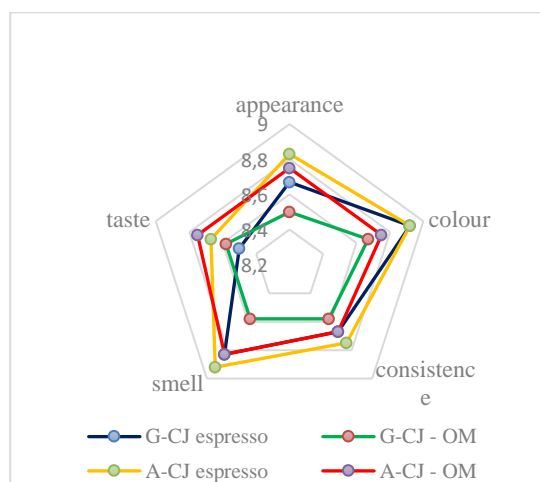


Figure 1 – Sensory evaluation score of coffee jellies

The results of physico-chemical parameters are presented in table 2.

Table 2 Physico-chemical characteristics of coffee jelly

Characteristics	G – CJ Espresso	G-CJ OM	A - CJ Espresso	A- CJ OM
Moisture, %	36.4±1.89	38.3±3.64	29.5±1.4	31.1±2.05
Acidity, grades	0.4±0.03	0.37±0.03	0.25±0.02	0.22±0.02
TSS, brix	48.2±1.5	49.6±1.7	44.4±2.0	46.1±2.2

The highest moisture content was found in the gelatin jellies, 36-38%. These values are higher than those reported by Raba *et al.* [15]. The lowest water content was detected in the jelly samples prepared with agar-agar. The samples with oat "milk" recorded higher values than those with "espresso" coffee.

The acidity of the jellies was influenced by the type of gelling agent used. The highest acidity was recorded in the gelatin jellies (0.37-0.4 acidity degrees).

Also, the jellies with "espresso" coffee had higher values than those with oat "milk."

The total soluble solids content was between

44.4 and 49.6 degrees Brix. The highest values were recorded in the jelly samples with gelatin, and the lowest in the jellies with agar-agar. The addition of oat "milk" led to an increase in TSS in all types of jellies. The TSS values for coffee jellies were much lower than those found by Raba *et al.* [15].

The antioxidant activity (RSA) of the jellies was between 36.29% and 38.71% for all types of jellies, with coffee being the main ingredient with antioxidant potential in these jellies, and the concentration of this in all variants was the same (Figure 2). In the specialized literature, RSA values for coffee extracts have been

reported in various solvents, from 45 - 50% [11, 12].

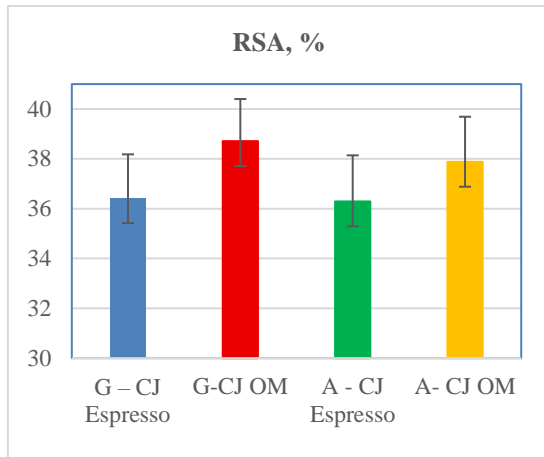


Figure 2 Antioxidant activity (RSA) of coffee jellies

The total polyphenol content recorded values between 25.3 and 27.6 mg GAE/g, being higher in the "espresso" variants and in those with gelatin. Literature data are very diverse, varying depending on the extraction solvent, the roasting degree of the coffee beans, etc: 10-17 mg GAE/g [1], 74 mg GAE/g [3], 97.07 mg GAE/g [6], 226 mg GAE/g [11].

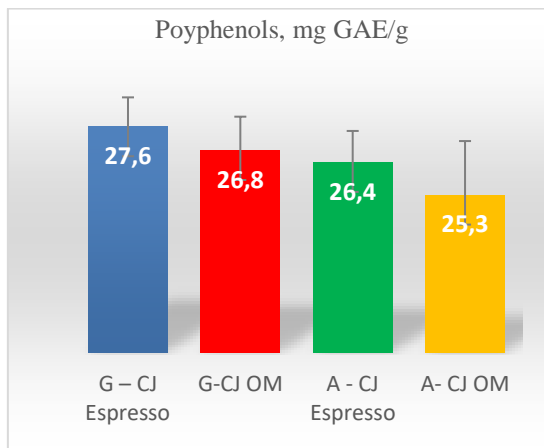


Figure 3 Total polyphenols content of coffee jellies

The proximate composition of the jellies is presented in Figure 4.

It observed a low lipid and protein content of the coffee jellies.

An important aspect of the nutritional declaration is that the jellies contain considerable amounts of dietary fiber. The highest amounts of fiber were observed in the jellies with agar (43.57-44.38%), and the

least fiber is found in the jellies with gelatin (3.6-5.2%). This high fiber content recommends agar jellies for supplementing the diet with dietary fiber. Moreover, an encouraging aspect was that the sugar level in the jellies was low (2.38-4.96%).

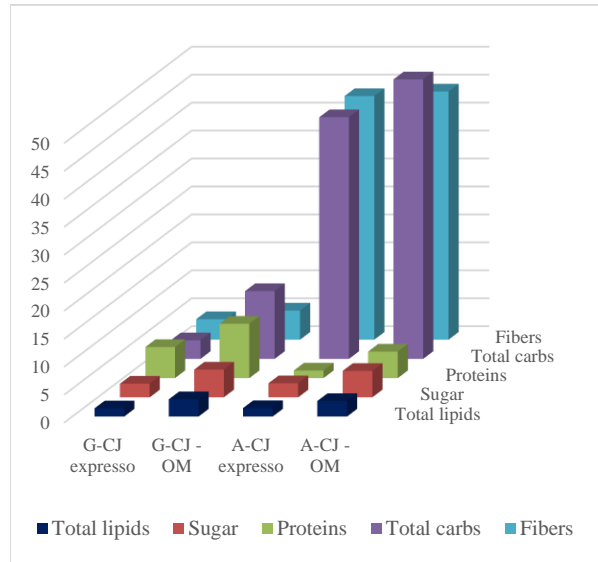


Figure 4. Proximate composition of coffee jellies.

The energy values of the jellies were between 110.88 and 183.42 kcal/100 g. The jellies with the addition of oat "milk" had more calories than the others. The jellies with gelatin had the highest energy value.

4. Conclusions

This work presents some aspects regarding the gastronomic and nutritional potential of coffee, offering a new perspective on how it can contribute to consumer health. The jellies obtained were readily accepted by consumers in Romania, creating the premises for technological transfer to the food industry and the HoReCa sector, by including them in the menus of restaurants and cafes, offering customers an innovative and refined culinary experience.

The results of this study showed that coffee jelly is a valuable product, with remarkable sensory properties. Also, in the coffee jelly, a high content of antioxidants, polyphenols, and dietary fiber was found, while lipids and sugar were in low amounts.

The study also highlighted the sensory and physicochemical characteristics conferred by the two gelling agents, the advantages and disadvantages of using each of them.

Compliance with Ethics Requirements

Author declares that he respects the journal's ethics requirements. Author declares no conflict of interest.

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